Monitoring Landscape Change in Lake Clark National Park & Preserve Using Historical Photography

ABSTRACT

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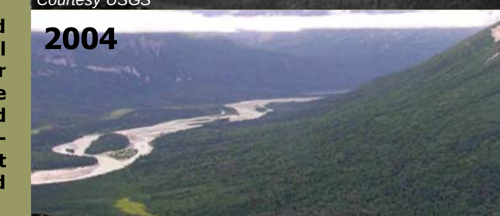
A project was initiated in 2003 to assess landscape changes in the Southwest Area Network of National Parks through the use of repeat photography. A total of 192 historical photographs were acquired for Lake Clark National Park & Preserve, the oldest dating to 1895. The most abundant collections of photographs were those from USGS geologists Capps (85 from 1927 to 1929), Moffit (22 from 1920 and 1921), and Grantz (20 from 1950). In 2004, 60 photographs were repeated using a helicopter. Emphasis was on medium-range subjects (50–500m distance) related to coastlines, glaciers, landslides, floodplains, lakeshores, tree-shrub expansion, and plant succession.

Comparison of historical and recent photographs indicates that many geomorphic and biological processes have created dynamic changes in the park. The Tanaina Glacier at Lake Clark Pass has retreated ~1.4 km from 1940 to 1999, with most of the retreat occurring between 1954 and 1979. Mudflats along Chinitna Bay uplifted during the 1964 earthquake have been colonized by halophytic wet meadows as evident from 1921 photography. White spruce trees and alder shrubs have made substantial upward expansions at several locations in the northern part of the park as evident from photos from 1927–1929. However, liittle change is apparent in alpine tundra communities well above treeline. Channel migration create new disturbance on the floodplains.

Tundra Vegetation Succession

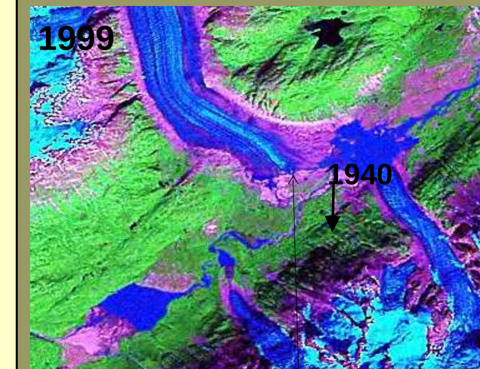
Photographs from 1929 (Stephen Capps) and 2004 (Jorgenson) reveal little change in alpine tundra on the morainal ridge overlooking Telaquana Lake. There is some evidence that dwarf birch shrubs have formed a denser ground cover, obscuring some of the rocks, but there has been little change in height. No expansion of trees or tall shrubs is evident on the slopes at an elevation of 825 m.

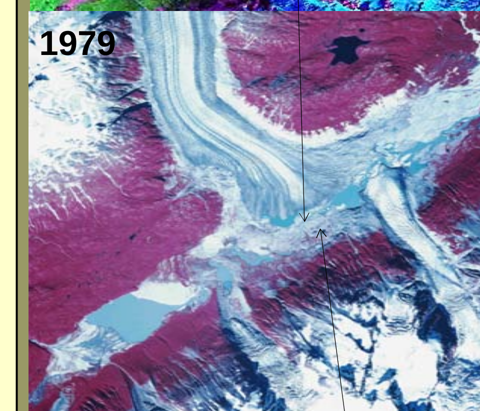
Floodplain Dynamics



Photographs from 1909 (Frank Katz) and 2004 (Jorgenson) reveal substantial channel migration on the Tlikakila River over the 95-year interval. Note reconfiguration of the large island (foreground) and revegetation of the mid-channel bar. Behind the island, the left side of the floodplain has stabilized and become vegetated.

Glacial Retreat



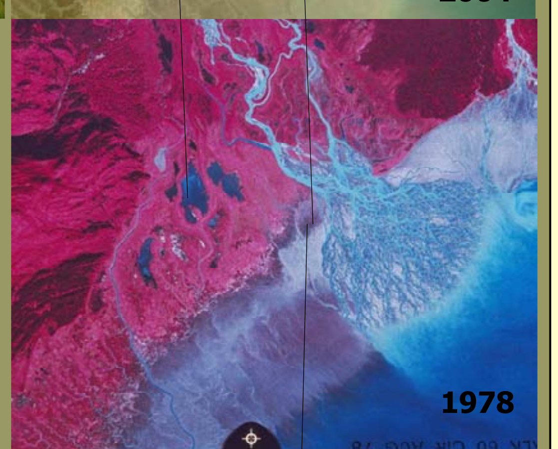


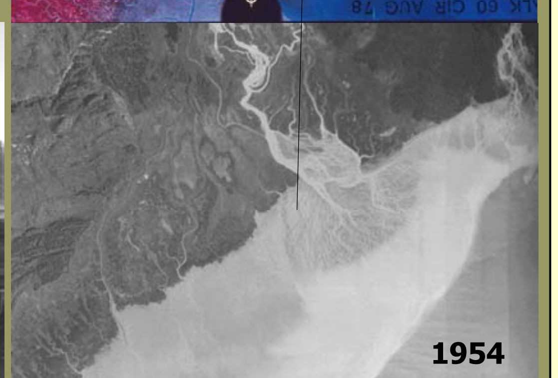
Images from 1999 (Landsat), 1979 (AHAP CIR), 1973 (Williams), 1954 (USGS), and 1940 (Park) reveal the Tanaina Glacier has retreated ~1.4 km over a 59-year period. Most retreat occurred during 1954-1979, with minor retreat during 1979-1999, although the early faster retreat was probably related to the thinner ice at the glacier margin.

Coastal Dynamics After Uplift from the 1964 Earthquake

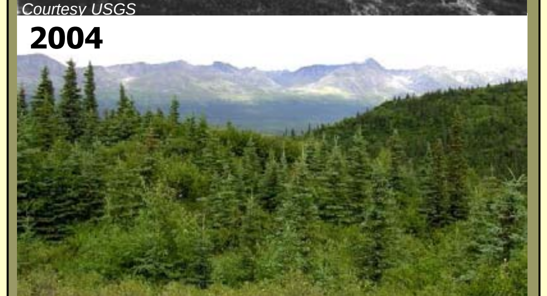
Effects of coastal uplift in Chinitna Bay from the 1964 earthquake is evident from airphotos from 1954 and 1978 and a Ikonos image from 2004, and from ground photographs from 1921 (Moffit) and 2004 (Jorgenson). Ground photos of Seal Spit show development of a lush coastal wet meadow and the establishment of several Sitka spruce trees on the gravel spit.

The airphotos and satellite images Little Glacier Creek show extensive development of salt marsh vegetation on the mudflats. Most change is evident from 1954 to 1978. On higher, inactive mudflats many tidal ponds drained by 2004. Little change is evident in the network of tidal guts





Treeline Expansion



Photos from 1928 (Stephen Capps) and 2004 (Jorgenson) near Two Lakes show a dramatic increase of white spruce near treeline at 710 m. White spruce in 1928 (background) indicates the tree expansion is due to treeline expaqnsion and not recovery from fire.

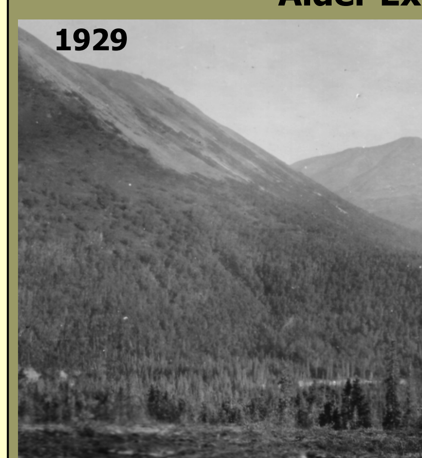
Succession After Fire

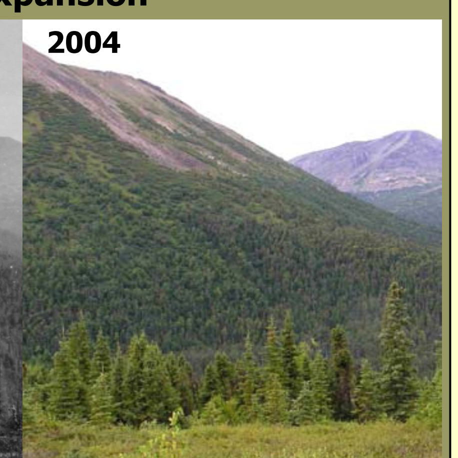
Photos near Tanalian Falls from 1909 (Frank Katz) and 2004 (Jorgenson) reveal dramatic changes in vegetation after a fire shortly before 1909. Scattered white spruce survived the fire and overtop the 90-yr-old, closed birch forest.

Shoreline Stability

Photos by Chester Purington in Cook Inlet in 1895 provide the oldest collection of photos. The 2004 photo (Jorgenson) reveals little change in the bedrock coastline and the persistence of alder shrub vegetation along the cliff.

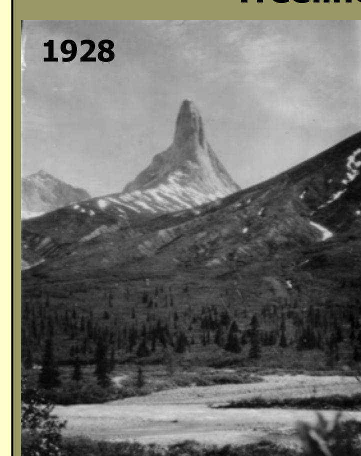
Alder Expansion

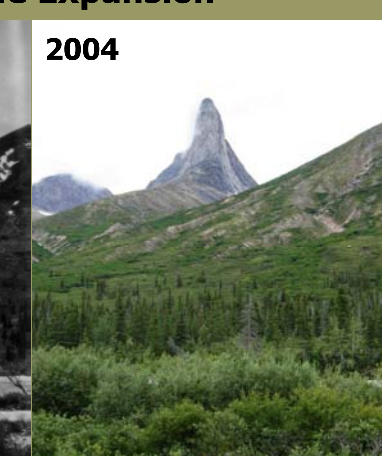




Photos from 1929 (Capps) and 2004 (Jorgenson) of a mountain along the Kijik River show upward expansion of alder in the subalpine zone. Lower on the slope, white spruce have emerged above the canopy and dominate the mixed spruce-birch forest.

Treeline Expansion





Photos of The Tusk from 1928 (Capps) and 2004 (Jorgenson) reveal little change in treeline at 600 m. although spruce trees have grown larger and denser. Willows and cottonwood along Another River increased.